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T-RELM: CREATING A SUSTAINABLE FRAMEWORK FOR TESTING EARTHQUAKE FORECAST MODELS

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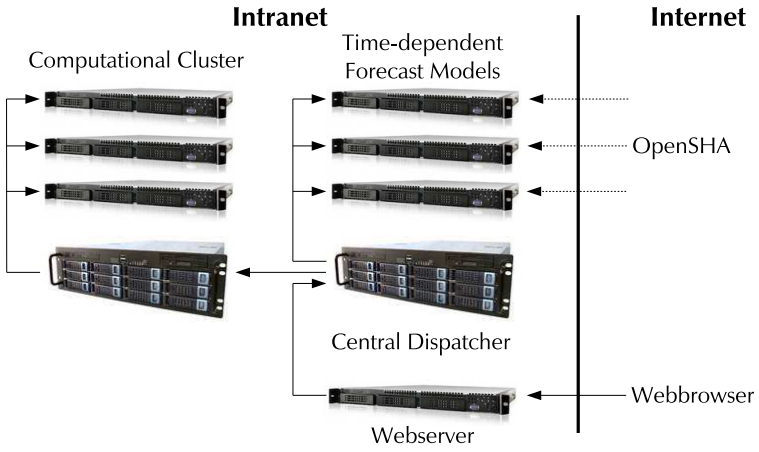

Figure 1: Schema of the computer setup for the Testing Center. The Central Dispatcher is conducting the tests and storing the results. Each time-dependent model runs on a model computer, additionally accessible from the internet via OpenSHA. All results will be presented on the webserver.

1 RELM Testing Center

Danijel Schorlemmer, leader of the T-RELM effort, designed the Testing Center (Figure 1). The necessary computer infrastructure was purchased by ETH in Zurich. The computer cluster is operational and the first model computer was set up. The Central Dispatcher is under development and will soon start operating.

Over the next month, several time-dependent models will be installed at the Testing Center, which will accordingly be extended by more model computers.

During the RELM workshop at Lake Tahoe, the ANSS catalog was chosen as authorized data source for testing. In several discussions, Danijel Schorlemmer explored additional potential autorized data sources in oder to extend the variety of models testable in the Testing Center. The most promising candidate are automatic slip distribution provided by the USGS.

For integrating the Testing Center with OpenSHA, Danijel Schorlemmer and Silvio Maraini (ETH) visited the USGS office in Pasadena in June/July 2005. Silvio Maraini set up a model computer in the Testing Center in Zurich to interface with the OpenSHA framework. One test model has been installed during this collaboration.

The only open question which remained after the multiple RELM workshops was the declustering algorithm to be used in testing stationary models. During the aforementioned visit, Matt Gerstenberger, co-leader of T-RELM, and Danijel Schorlemmer developed a probabilistic approach to the declustering algorithm designed by *Reasenberg* [1985]. The probabiilistic approach is necessary for assigning each event in the catalog an independence probability p_I of being an independent event (not part of an aftershock sequence). There probabilisites allow for including the uncertainty in independence into the testing. Because the direct approach developed was to computationaly intensive, Matt Gerstenberger and Danijel Schorlemmer decided to Monte Carlo simulate the algorithm by *Reasenberg* [1985] with changing input parameters. They also generated an example catalog which is provided

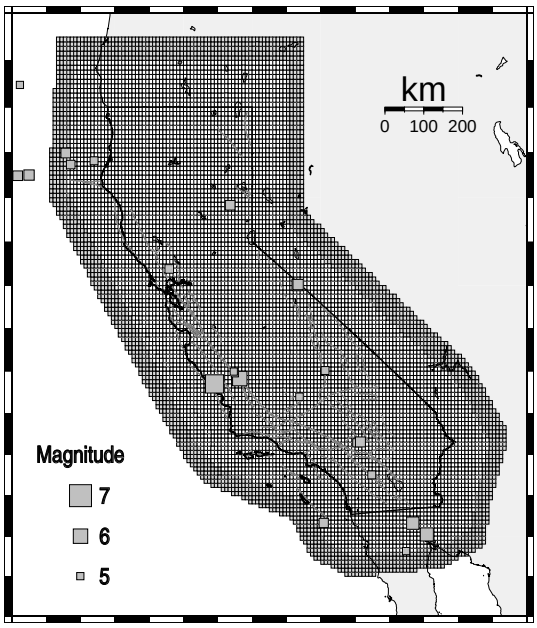

Figure 2: Testing and collection area. The white squares indicate spatial cells of the testing area. The cells extending the testing area to the collection area are drawn in gray. Main faults are indicated with gray lines. The squares mark earthquakes of magnitude $M \geq 5$ of the ANSS catalog in the period 2000–2005.

at the testing website.

During this visit, also the testing area grid was defined together with the network operators, namely David Oppenheimer and Egill Hauksson. The grid is shown in Figure 2. Danijel Schorlemmer together with Silvio Maraini started the development of the testing website which will be linked from the official RELM website (`www.relm.org`).

The complete specifications of the testing classes (choice of free parameters) and the Testing Center has been submitted as a paper to the RELM special issue [*Schorlemmer and Gerstenberger*, submitted].

2 Asperity Likelihood Models for California

Many progress has been achieved with the Asperity Likelihood Model (ALM), also a participant of the RELM testing effort. ALM was initially proposed after discovering the large b-value contrasts at Parkfield [*Wiemer and Wyss*, 1997]. In 2004, *Schorlemmer et al.* [2004a] quantified the stationarity of b-values and *Schorlemmer et al.* [2004b] investigated their predictive power. The Parkfield 2004 event showed that the expectation that the low b-value volume corresponds to the asperity and is likely to rupture in the anticipated event was justified [*Schorlemmer and Wiemer*, 2005]. Furthermore, *Schorlemmer et al.* [2005] have shown, that b-values are inversely correlating with stresses in the Earth.

Taking all these observations into account, *Wiemer and Schorlemmer* formulated the

Asperity Likelihood Model, generated the forecast (Figure 3), and submitted its description to the RELM special issue.

3 Summary

T-RELM aims to create a framework for testing earthquake forecasts. During the budget period, the testing procedure and the concept of the testing center have been developed. The community of participating forecast modelers have agreed upon the procedure and are preparing their forecasts to be submitted to the testing center. The center itself is currently under development and will be operational next year.

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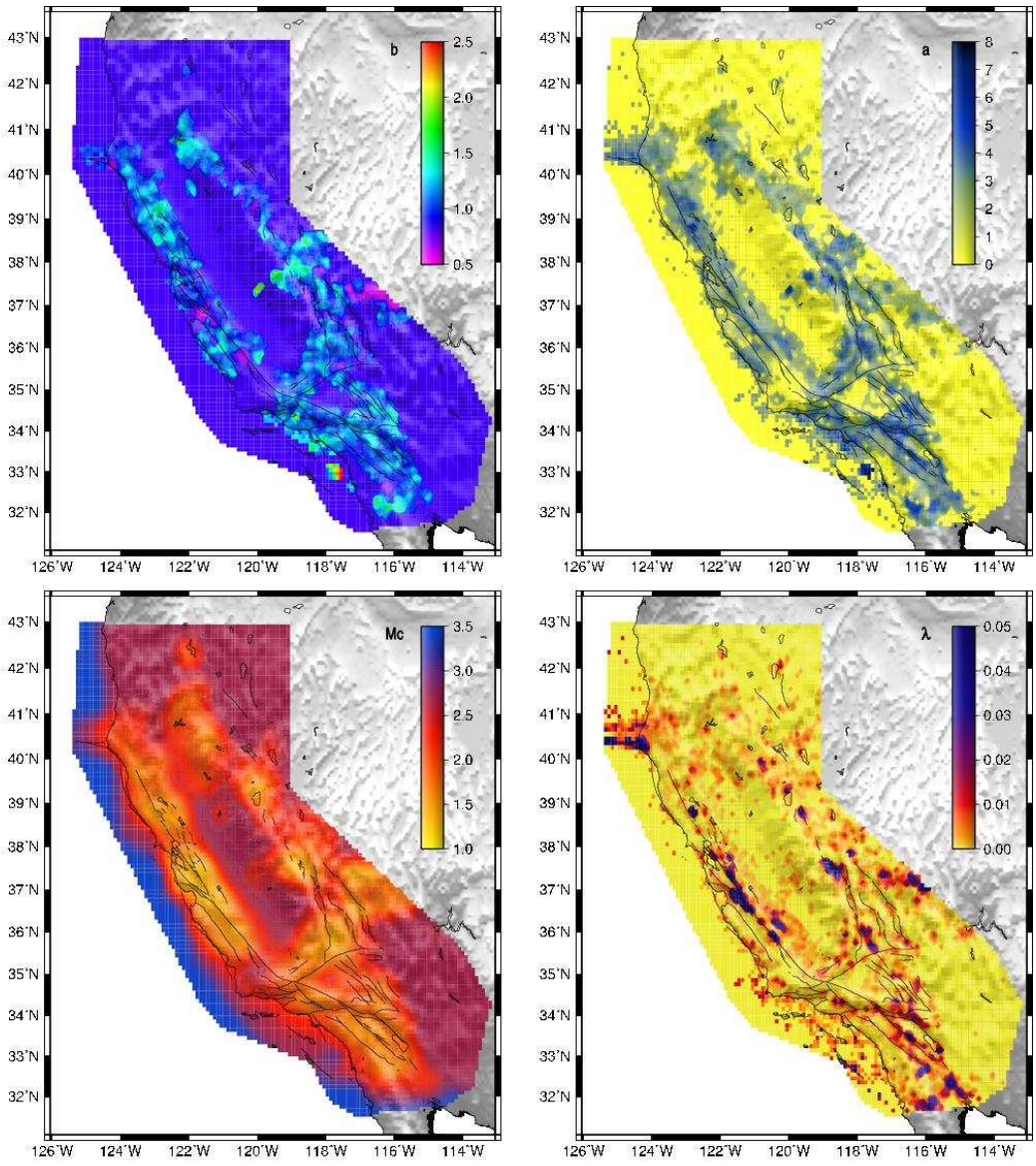

Figure 3: Maps of (top left) b-values, (top right) a-values, (bottom left) magnitude of completeness, M_c, and (bottom right) the forecast for $M \geq 5$ events of our model.